SECTION 2.3 CONSTRUCTION ON SITE
(WAC 463-42-145)

2.3.1 PROJECT DESCRIPTION

The project consists of the construction of a 231-mile refined products pipeline from Woodinville, Washington, to Pasco, Washington, and the construction of 3 pump stations, Thrasher, North Bend, and Kittitas. As demand on the pipeline grows, an additional three pump stations may be constructed at Stampede, Beverly-Burke, and Othello. In conjunction with the pump station in Kittitas, a storage and distribution facility will be constructed, including a truck loading facility for the loading of gasoline onto tanker trucks for the central Washington market. The terminus of the pipeline is at the Northwest Terminalling facility in Pasco, where a meter facility will be built to connect to existing facilities.

2.3.1.1 Summary of Existing System

Olympic Pipe Line Company's (OPL) existing system consists of approximately 400 miles of petroleum product pipelines, extending from refineries in northwestern Washington, continuing south through western Washington and terminating in the vicinity of Portland, Oregon. Refined petroleum products transported in the existing system are the same as will be transported in the proposed Cross Cascade Pipeline, including various grades of gasoline, aviation turbine fuel, diesel fuel, and heating oil. The existing system originates with a single 16" mainline at the ARCO Cherry Point Refinery and the TOSCO Northwest refinery near Ferndale, Washington. The 16" mainline continues south to the Allen Station where the mainline is joined by a petroleum product line from the Shell and Texaco refineries near Anacortes, Washington. Dual main lines (16" and 20") transport petroleum products from the Allen Station to the Renton Station. A single 14" main line runs from Renton, Washington, to Portland, Oregon. The Seattle and Sea-Tac Delivery Facilities are served by 12" lateral lines. Lateral lines of 6", 8", and 12" carry products from the 14" main line to the Olympia, Tacoma, and Vancouver Delivery Facilities, respectively.

The OPL Sea-Tac Delivery Facility consists of 8 in-transit storage tanks, with a cumulative storage capacity of 584,000 barrels. This facility stores aviation turbine fuel prior to transfer to airline metering facilities and a truck refueling rack at Sea-Tac International Airport. All main line and booster pumping stations are driven by electric motors, with a total horsepower in excess of 43,000. The existing system is operated via remote control from the Renton Control Center, co-located with the Renton Pump Station in Renton, Washington.

The proposed Cross Cascade Pipeline will tie into the existing pipelines approximately two (2) miles north of the King-Snohomish county line near Maltby Road, east of Thrashers Corner. From the point of origin to Kittitas, the pipeline will be 14" in diameter. The proposed pipeline will extend east and southeast crossing Snoqualmie Pass, into Kittitas County traversing north of Ellensburg and then southerly to Kittitas where a storage and distribution facility will be constructed. From Kittitas a 12" pipeline will continue easterly along the north side of I-90 into Ginkgo State Park and then cross under I-90 near the town of Vantage, continuing on State Park land parallel to an existing roadway and cross under the Columbia River downstream of the Wanapum Dam. From the dam, the pipeline will go east along the base of the Saddle Mountains before turning south and terminating at Northwest Terminalling Company's existing terminal in Pasco. Please see Figure 2.1-1 in Section 2.1 Site Description, for a general project vicinity map.

The pipeline will be installed with an impressed-current cathodic protection system to prevent corrosion. Generally, a 30' wide right-of-way will be maintained over the length of the pipeline during operation to facilitate the aerial observation of the right-of-way, except in environmentally sensitive areas.

The planned pipeline route is shown on Figure 2.1-1 and in the Map Atlas in Appendix A. Approximately 96 miles of the new pipeline will be constructed in or directly adjacent to existing rights-of-way, including BPA and other electrical transmission corridors, roads, trails, and railroad grades. There are five proposed pump stations; four are expected to require approximately 1.0 to 2.0 acres; and the fifth pump station, Thrasher, will occupy approximately 3.7 acres. The Kittitas Terminal, which also includes a pump station, will be constructed on approximately 27 acres.

Total cost of the project is estimated at approximately $105 million. Construction costs are shown by County in Table 2.3-1.

TABLE 2.3-1
ESTIMATED CROSS CASCADE PIPELINE CONSTRUCTION COSTS

County	Construction	Cost $
Snohomish	Pump station (Thrasher)	869,840
	14" Pipeline	5,130,002
King	Pump station (North Bend)	852,121
	14" Pipeline	15,939,650
Kittitas	Kittitas terminal/pump station	10,304,895
	14" Pipeline	24,426,259
	12" Pipeline	9,468,399
Grant	12" Pipeline	11,364,537
Adams	12" Pipeline	3,502,513

County	Construction	Cost $
Franklin	12" Pipeline (new line under delivery facility)	15,060,221
	Delivery Facilities	603,959
Sales Tax		7,596,951
TOTAL PROJECT COSTS		105,119,347

2.3.2 PIPELINE DESIGN ELEMENTS

2.3.2.1 Pipe Wall Thickness Design

Barlow's formula, as shown in the American National Standards Institute (ANSI) Standard Code Number B31.4, is used in the pipeline industry to calculate the required pipe wall thickness to contain a given internal pressure. The U.S. Department of Transportation, Office of Pipeline Safety (USDOT, OPS) requires that the results yielded by the calculations be divided by 0.72 to provide an additional safety factor. Another safety factor is introduced during the design by the fact that pipe wall thicknesses come in only so many sizes and pipeline designers round the calculated wall thickness up to the next larger size when ordering pipe.

The pipe used for the project will meet or exceed American Petroleum Institute (API) 5L X-52 requirements. The Specified Minimum Yield Strength (SYMS) for the pipe will be a minimum of 52,000 psi. The standard wall thickness will be 0.281" for the 14" pipe and 0.250 for the 12" pipe. Pipe with a increased wall thickness will be used in selected locations to allow the pump stations to operate at full rated discharge pressure. In these instances the pipe will have a minimum wall thickness of 0.312" for the 14" pipe and 0.281" for the 12" pipe.

Pipe with increased wall thickness will also be used at road crossings, rail crossings, on bridges, and at stream crossings. API RP1102 requires that a site specific stress calculation be performed to determine the required wall thickness for pipes crossing below roads and railroads. These stress calculations will be performed prior to construction, and the pipe wall thickness increased beyond the minimum specified above. For both road and railroad crossings, the pipe will be coated with 1000 mils (1 inch) of concrete overlaid on the standard coating.

Final engineering design for bridge crossings will determine whether there will be a need to increase the proposed wall thickness beyond the minimum specified above. The pipe will be coated with 1000 mils (1 inch) of concrete overlaid on the standard coating.

For river crossings, the pipe wall thickness will be increased to a minimum of 0.5" for the 14" pipe and a minimum of 0.5" for the 12" pipe. For drilled crossings, the pipe will be coated with 16 mils of fusion bonded epoxy overlaid with 60 mils of powercrete or CT urethane. For trenched crossings, the pipe will be coated with a minimum of 40 mils of high density polyethylene surrounded by 1" of standard concrete.

2.3.2.2 Pipe Yield Strength

The American Petroleum Institute (API) Specification 5L requires a minimum yield strength be supplied to the purchaser. To ensure that this minimum is achieved for each joint of pipe supplied, the pipe manufacturer will make the pipe slightly stronger than specified. The result is an added safety factor for containing internal pressure.

2.3.2.3 Purchased Pipe

Pipe purchasers also benefit from another "incidental" safety factor which arises from the different ways in which the steel plate is sold to the pipe manufacturer and the way the manufacturer sells pipe to the purchaser. Steel plate is sold to the manufacturer by the pound and tends to come at a greater thickness than specified. Pipe is sold by the foot at or greater than the specified wall thickness; the pipe buyer thus usually benefits from the extra wall thickness sold to the manufacturer.

2.3.2.4 Welding Procedure Specifications

Pipelines are welded in the field using the Shield Metal Arc Weld (SMAW) technique. A welding procedure specification (WPS) is developed according to API Standard 1104 before the pipeline is to be constructed. The welding procedure specifies all of the essential variables used to perform the procedure. Also, well before construction begins, the welding procedure specification is qualified by fabricating a test weld using all of the specified essential variables. The test weld is then destructively tested to make sure that the welding procedure specification produces a weld which is stronger than the base metal. A Procedure Qualification Record (PQR) is generated to document results of the destructive tests. The successful Welding Procedure Specification supported by the Procedure Qualification Record becomes part of the construction specifications.

2.3.3 PIPELINE CONSTRUCTION

The pipeline will primarily be constructed underground across land and under rivers, streams, and roadways. In some cases the pipeline will cross on bridges to avoid sensitive areas. The anticipated construction methods to be used for upland construction of the pipeline are briefly described below along with general information on construction. Procedures specific to water crossings and construction in wetlands are discussed in Section 2.14 Construction Methodology.

2.3.3.1 Right-of-Way Construction

The width of the area required for pipeline construction will vary according to site-specific conditions. In general, the construction right-of-way will be approximately 60' wide.

Construction and permanent easements for the pipeline will be negotiated with property owners. OPL anticipates making one payment to each affected property owner for the easement and expected inconvenience for the temporary loss of planting that may occur during construction. Landowners will also be compensated for crop damage and the other compensable losses that may result from pipeline maintenance.

In general, the right-of-way easements obtained from public agencies and private landowners will give OPL the right to survey the route, clear and grade the right-of-way to accommodate construction, install the pipeline, clean up the right-of-way and return it to grade, revegetate, and provide later access to the right-of-way for operation and maintenance. Temporary access to the right-of-way across existing access roads will also be negotiated.

2.3.3.2 Pipe Staging Areas and Contractor Construction Yards

Pipe Staging Areas

Four to five locations along the proposed pipeline corridor will be selected as pipe staging areas, although not all of these areas may be used. Pipe staging areas are locations where the pipe joints can be unloaded from railcars and temporarily stored while they await distribution (stringing) along the right-of-way. Currently, sites have been identified in Pasco, Royal City, Ellensburg, and Easton in Eastern Washington. The primary pipe staging area in Western Washington will be located in Everett.

The staging areas will be 15 to 30 acres each and will be located adjacent to active or refurbished rail sidings. The final selection of staging sites will be based on the condition of the rail sidings, the availability of land to stack pipe, the proximity to an improved highway, and its location relative to the construction spread. As many as 125 railcars loaded with pipe will be delivered to the site in batches of 5 to 30 cars each. The number of cars in each batch will be determined by the railroad company dispatcher. The pipe joints will be unloaded by crane and forklift and will be stacked on earthen berms. Traffic in and out of the site will be very light, consisting only of the equipment operators and an inspector arriving in the morning and leaving at the end of the work day.

Later, when the pipe is ready for stringing along the right-of-way, semi-trailer trucks will haul away a maximum of 20 joints at a time. Traffic will include the stringing truck making 10 to 20 round trips per day. The pipe stringing period from Eastern Washington staging areas may last up to three weeks and up to six weeks for Everett.

It will not be necessary to have either phone or power installed at the staging areas and only temporary sanitary facilities will be used.

Contractor Construction Yard

As part of the preparations for construction, the contractor will locate and make arrangements to secure a 10- to 20-acre yard area for use by construction crews. This area will be used to locate office trailers, storage trailers, and fuel tanks, and will operate as an assembly point for construction crews to meet prior to proceeding on to the right-of-way. The contractor will have electricity and phone service installed in office trailers and will arrange for temporary sanitation facilities for personnel. Traffic volumes of the construction yard will vary greatly, ranging from 30 to 40 vehicles arriving and leaving at the start of the workday to just a few vehicles per hour during the day. Crews may be picked up at their place of lodging to reduce requirements for onsite parking. There will be no assembly of workers in the evenings. Occasionally, large trucks will arrive to deliver materials and supplies, but these arrivals will be infrequent.

2.3.3.3 Land Pipeline Construction

Figure 2.3-1 illustrates a typical construction spread that will be used for the proposed pipeline. Specific procedures for each pipeline segment will depend on the conditions identified during final engineering and design studies. No new access roads will be required for construction of the proposed pipeline.

FIGURE 2.3-1 - TYPICAL CONSTRUCTION SPREAD

Construction is expected to be accomplished in three pipeline "spreads." Each spread is a coordinated crew that is comprised of the major construction crew and equipment necessary to complete entire sections of pipeline installation from start to finish. Spreads 1 and 3 will be designated to work from the east and west ends of the pipeline toward the middle. These spreads will follow the general construction procedures described below. It is anticipated that Spreads 1 and 3 will lay between 10,000 and 12,000' of pipe per day. Spread 2 will work in mountainous terrain and narrow rights-of-way; this area extends from approximately east of the town of Snoqualmie to the east end of Lake Keechelus. Spread 2 will also generally follow the construction procedures as described below; however, the crew will be smaller and the total construction operation will be more compact. It is anticipated that Spread 2 will lay approximately 2,000' of pipe per day.

Several construction units will make up each spread, with the work proceeding generally in the following sequence.

1. Surveying
2. Fencing and erosion control
3. Grading
4. Ditching
5. Pipe stringing
6. Bending
7. Pipegang (line-up, weld root and hot passes)
8. Firing Line (complete weld with filler and cap passes)
9. Tie-in
10. Radiography (X-Ray)
11. Weld Repair
12. Joint Coating
13. Pipe lowering-in
14. Backfill and Cathodic Protection
15. Road and Railroad Crossings
16. River, Stream and Canal Crossing
17. Pipe Cleaning and Hydrostatic testing
18. Cleanup, Restoration and Revegetation
19. As built surveying

The sequence of construction is described below.

Surveying

Prior to any construction, the route will be surveyed and the proposed centerline staked. The outer boundaries of the construction corridor will be also be staked. Generally, the proposed centerline of the pipeline will not be in the center of the construction right-of-way, but will be offset to one side. The overburden (excavated material) will be placed on the narrow side of the construction corridor. On the wider side there will be room for two vehicles to pass and a work area for laying and welding the pipe. The limits for clearing will be clearly marked. An environmental specialist will accompany the survey crews to clearly mark/flag sensitive environmental areas.

Fencing and Erosion Control

Temporary Fence Installation

A fencing crew will begin following the staked centerline of the pipeline and will install temporary gates and fencing where the right-of-way crosses through a land owner's fence. Prior to cutting the fence, it will be braced at the boundaries of the construction corridor for a minimum width that would allow the passage of construction equipment. The bracing allows the fence to be cut and still maintain integrity. Temporary wire gates will be installed across the width of the construction right-of-way that will allow the ditch to be excavated, and will provide room for the pipe and construction equipment to pass.

Timber Clearing

The general contractor will use local timber crews whenever feasible to clear the right-of-way of all merchantable timber. Logs will be removed to mills in accordance with agreements negotiated with landowners when the right-of-way is obtained. Smaller timber will be properly disposed of or cut and stacked on the right-of-way for use by the landowner for firewood or posts, if appropriate. It is anticipated that construction of the proposed pipeline will require a minimal amount of timber to be cut, because the right-of-way follows existing corridors that have already been cleared.

Clearing

After temporary fencing and timber clearing have been accomplished, the right-of-way crew will be given access to the right-of-way. This crew will remove stumps shrubs, and topsoil. An erosion and sedimentation crew will work with the clearing and grading crew to ensure that the erosion prevention and control structures are in place during clearing. When work is done along a hillside, the topsoil will normally be placed on the uphill side to prevent mixing with other excavated material during later stages of construction. As small an area as possible will be leveled to allow the construction equipment room to work. In areas along the sides of hills ("sidehilling"), two levels may be necessary. One level will contain the ditch and material removed from it. The second level will accommodate the pipe fabrication area and the construction equipment and passing lanes. This technique reduces the amount of material which must be displaced during the temporary construction phase of the work. Approach areas will be created at the tops and bottoms of hills to provide an area for equipment and pipe to transition from level areas to steep inclines.

Depending on the total volume, size of material, location along the right-of-way, and land owner requirements, woody debris may be piled along the right-of-way; otherwise, it will be used for habitat enhancement, buried on site, chipped on site, or disposed of in an approved disposal site. In most cases, the construction contractor has final responsibility for disposal of the construction debris in an approved manner.

Erosion Control

After construction zone clearing is completed, erosion control measures will continue to be implemented in accordance with the OPL Erosion and Sediment Control Plan for the specific topography and soils along the pipeline route (see Section 2.10 Surface-Water Runoff). Methods will be site-specific, depending on the soil conditions, slope, and other site-specific variables, but may include silt fences, straw bales, rock bases, and sedimentation ponds. Once a level access is prepared, dust control will be accomplished as necessary by periodically spraying from water trucks.

Grading

Grading is required along the route where grading has not previously been accomplished, such as along the BPA corridor, privately owned properties, Ginkgo State Park, and other uncleared and ungraded areas. Typically, equipment such as bulldozers and motor graders provide a working corridor to the width of the construction easement to furnish efficient working space for all the crews that will follow. The work pad will resemble an unpaved road, however the grading will be less than that needed for a road because construction equipment can negotiate steeper and more uneven terrain than passenger vehicles. The cuts in the graded areas will be kept to a minimum to facilitate restoration of the corridor at the completion of the construction period.

Ditching

Typically, within 24 hours of the time the construction zone is cleared and leveled, trenching machines will dig the trench. The trenching crew usually consists of a trenching machine, a diesel refueling truck, and a maintenance pickup. A trenching machine--capable of cutting through all types of soils except where there are very large boulders--cuts the trench and side casts the soil. Depth of the trench can vary, but wherever possible the trench would be to a depth to maintain 48" of cover over the pipe, which exceeds U.S. Department of Transportation (DOT) regulations. In most cases, a minimum of 36" of compacted dirt is required over the pipeline. Materials removed from the ditch will be placed adjacent to the topsoil pile. Trackhoe equipment will usually be used to dig the ditch in hilly or mountainous terrain. Extra ditch depth will be excavated to accommodate the transition of the pipeline at the bottoms and tops of hills, at water crossings, road crossings, and railroad crossings.

On occasion, more sophisticated equipment may be required. Trenching machines equipped with special blades are capable of trenching through soft rock, and other equipment similar to concrete cutting machines can cut through rock to the desired depth. Only in rare circumstances would blasting be used to cut through rock. When blasting is required, the charges are shaped to limit the amount of outward explosion. To limit the amount of debris spread, heavy mats are placed over the charges. These mats also reduce the level of noise from the blast itself. In rock, the DOT regulations require a minimum of 30" of cover over the pipeline. Under special circumstances the DOT can provide an exception to the regulations for rock and allow a minimum of 18" of cover over the pipeline.

Pipe Stringing

Pipe stringing may be occurring concurrently with trenching. In some cases, pipe stringing precedes trenching, and in others, lags by up to 72 hours. The further the pipe stringing is behind the trenching operation, the longer the open trench is subject to erosion and may present a safety hazard. In cases where the trench is to remain open for extended periods, it may be barricaded.

Precoated (corrosion protected), 40' pipe joints will be hauled to the right-of-way on stringing trucks. The pipe will be unloaded from the trucks with a sideboom tractor and placed end-to-end alongside the ditch. Where water and road crossings are to be accomplished, the appropriate pipe will be stockpiled on one or both sides of the crossing so it is available to the construction crews that will follow. Depending on access and terrain, the trucks will off-load the pipe and then return to the pipe lay-down area. In cases where there is a narrow construction corridor, the trucks will have to make a continuous loop by driving a significant distance up the corridor, off-load the pipe, and follow the corridor a significant distance to exit. If access is very limited, pipe will be hauled up the corridor by tractor and trailer and unloaded along the trench line.

Bending

Before the pipe is prepared for welding, a bending crew will bend the pipe in place where necessary to match the contours of the ditch. The crew will use a hydraulic bending machine to put gradual bends in the pipe. The bending will be limited to making many small bends along the length of a pipe section until the desired bend angle is obtained. The pipeline centerline will be surveyed with bending limitations in mind. Where the bend cannot be made gradually enough to meet specific conditions, a preformed factory bend will be inserted into the pipeline. These conditions will be identified prior to construction.

Pipegang

The front end or line up crew follows the pipe stringing and bending crews. The front end crew uses sidebooms to set the pipe on wooden frames (skids) that support the pipe off the ground and line the pipe up with the contour of the trench. Pipe ends are aligned and clamped in place. Once the pipe is clamped to hold the ends together the front end crew will make one welding pass, laying a stringer bead around the pipe to hold it in place. As soon as sufficient weld material has been deposited to hold the joint, the clamp is released and the crew moves forward to the next joint. The front end crew will weld together as many joints as practicable, which in level terrain may be 600 to 900' long.

Firing Line

The welding or firing line crew is the largest crew. In Spreads 1 and 3, it will consist of 70 welders using welding machines mounted on 20 to 40 pickup trucks. The welding crews follow and place the remainder of the weld material into the joint prior the final pass. A capping crew will follow immediately to put the finish "cap" weld on the joint. When completed, there will a minimum of 4 layers of welds per pipe joint. All welders that work on a joint have unique identifying codes. The codes are marked on the area adjacent to the pipe so complete records of the welding will be maintained.

In addition to qualifying the welding procedure, each individual welder is also qualified. The welder makes a weld using the actual pipe material to be used on the project using the qualified welding procedure. A Welder Qualification Record (WQR) is generated to document the successful qualification of the welder. The welder is usually qualified in the field just prior to the start of construction welding, ensuring the welder is both qualified and in practice for construction welds.

Tie-in

In order to tie pipe strings together, the backfilling crew will leave a significant portion of the end of the pipe string exposed. The second string is lowered into the trench so that it overlaps the backfilled pipe. The ends of the pipe are lifted, cut to fit, re-beveled, externally clamped in position, then welded together. The welds are radiographed while still exposed and then coated after being accepted by radiography. The pipe is then properly aligned in the ditch and the backfill completed.

Radiography (Non-destructive Testing)

Shortly after the welding crew has passed, an independent X-ray crew will test the welds. Each weld made during construction is inspected by radiography. Federal regulations require only 10 percent of each welder's welds be radiographed each day; however, OPL will require that 100 percent of all welds be examined. All of the radiographs are examined by an independent ASTM Level II Radiographer and evaluated according to API 1104 for welding flaws or pipe defects. The radiographs are also reviewed by the OPL welding inspectors as an additional level of quality control. Any radiographs of questionable quality are retaken. Any welds showing rejectable defects are flagged for repair. The welder has one opportunity to successfully remove the defect and repair the weld. If the attempt at repair is unsuccessful, the weld is flagged for removal.

Weld Repair

The Radiography crew reviews the X-ray film taken of each weld. When the Radiography crew finds a rejectable defect in a weld, the type of defect is identified, and either a template is made identifying the location of the defect or a measurement is made from the top button of the weld. This information is then given to the repair welder. The repair welder grinds the original weld metal out at the place indicated on the template or through the measurement, and re-welds the pipe only in that location using a pre-approved weld repair procedure.

Joint Coating

After the welds have been checked, the coating crew will clean the exposed steel at the joint between the pipes and apply a protective coating to it. The coating will be a heat-shrinkable polyethylene wrapped around the pipe. Heat will be applied to the coating material to shrink it around the joint and form a tight, impervious covering on the joint. After the joints have been coated, an inspection crew will check the pipe for nicks and abrasions in the coating with a high-voltage testing device. Chips or abrasions in the coating will sound an alarm on the test equipment and the crew will place a mark on the pipe to indicate the defect. Repair crews will patch the defects prior to lowering the pipe into the ditch.

Pipe Lowering-in

The pipe will be raised off the skids and lowered into the ditch by a team of sideboom tractors. All rock will be removed from the ditch prior to the lowering-in operation. In areas of rocky terrain, dirt or foam will be placed in the bottom of the ditch to protect the pipe from the rocky bottom. If appropriate, heavy duty plastic mesh will be wrapped around the pipe in rocky areas to protect the pipe and coating from damage during the lowering process. After the pipe is laid in the trench the wooden skids are picked up and moved ahead for the front end crew to reuse. All other debris is removed from the site and the trench is inspected to ensure that no debris has fallen into the trench.

Cathodic Protection

A cathodic protection system will be installed to protect the pipeline from corrosion. The cathodic system components and locations along the alignment will be determined during final design and engineering studies. Cathodic protection is an electrical method that prevents corrosion of the steel pipeline in water, wet soil or other corrosive conditions. Cathodic protection stops the corrosive process by changing the electrical conditions of the pipeline environment.

Cathodic protection prevents corrosion by generating an electric current which passes through the soil (electrolyte), creating a barrier at the pipe surface. This barrier is maintained by a continuous flow to the surface of the pipe. The current is supplied from anodes buried in the soil at intervals along the pipeline or at the other facilities.

There are two types of cathodic protection: impressed current systems and galvanic systems. For this pipeline, the impressed current system will be the primary method of corrosion control. The galvanic system will possibly be used at isolated locations.

An impressed current anode is placed in the soil either in a deep well ground bed or in a horizontal ground bed. (See Figures 2.3-1a and 2.3-1b) The anode is interconnected to a direct current (DC) source called a rectifier. The rectifier is energized by conventional alternating current (AC) power sources.

Figure 2.3-1a - TYPICAL HORIZONTAL GROUNDBED

Figure 2.3-1b Typical Horizontal Groundbed Anode Installation

Galvanic systems are sacrificial anodes. These anodes are buried reactive metals. When the metals are interconnected with the pipe surface, a battery is formed. Current flows from the anode material to the pipe, thereby corroding and sacrificing itself.

The text points for the cathodic protection system are installed at approximately one mile intervals by the backfill crew. These test stations provide the means to monitor how well the corrosion protection system is working and to make corrections when the need is indicated.

Backfill will normally be placed over the pipe string within a day of the pipe being lowered into the trench. Bulldozers will normally be used to push stockpiled materials removed from the ditch back into the ditch to cover the pipe. In areas that contain large quantities of rock, select fill material may be imported to put the first 12" of cover over the pipe, or special padding machines may be brought in to screen the rock from the backfill before it is placed in the ditch. Extreme care will be taken with the initial fill to avoid damage to the coating during backfill. After the initial 12" of screened material is placed on the pipe, the remaining soil and rock mixture will be returned to the open ditch to complete the backfill. The amount of backfill (cover) required between the top of the pipe and the ground level is presented in Table 2.3-2.

TABLE 2.3-2
COVER STANDARDS FOR BURIED PIPELINES

Location	Cover (inches)	
	Normal Excavation	Rock Excavation
Industrial, commercial and residential areas	36	30
Crossings of bodies of water with a width of at least 100' from high water mark to high water mark	48	18
Drainage ditches at public roads and railroads	36	36
Any other area	30	18

Note: These are minimum depths required by DOT regulations. OPL will strive for a minimum of 48" of cover at all locations where feasible.

Road and Railroad Crossings

Crossings will be installed concurrently with the mainline construction spread. Separate crews will install bored crossings of interstate highways and state primary and secondary roads. These crews will perform the excavation, boring or ditching, welding, and installation of the crossing pipe. All pipeline crossings of public thoroughfares will be 100 percent X-rayed before the pipe is installed.

Water crossings may be installed by separate crews, or depending on the schedule requirements, the same crew that installs the road crossings. All welds in a water crossing will be 100 percent x-rayed. (Construction methods for water crossings are described in Section 2.14 Construction Methodology.

Road Crossings: At locations where the pipeline must cross a roadway, the crossing will be accomplished by either the open-cut or jack and bore method. Figure 2.3-2 illustrates a typical road crossing. Jack and bore will be the least disruptive method, but this technique cannot be used effectively in areas where boulders or rock are present or for crossings longer than approximately 200'. Where jack and bore is not possible, the open cut method will generally be used. It is anticipated that all federal and state highways will be crossed using the jack and bore method.

FIGURE 2.3-2 - TYPICAL ROAD CROSSING

Jack and bore will require the digging of a large pit on one side of the road. The boring machine will be lowered into the pit to begin boring, with the pipe inserted into the hole as it is being drilled. The outside of the pipe will be coated with concrete or abrasion resistant material to protect the pipe coating from scarring and nicking as it is pushed through the bore hole. As each complete joint of pipe is installed, the boring shaft will be separated and another joint of pipe welded to the first joint. The shaft will then be reconnected through the new section of pipe and the boring will continue. This method will continue until the boring head and the pipe is received in a "capture" pit on the opposite side of the crossing. Since the pipe being installed will be the actual pipeline carrier pipe, all welds will be X-rayed as they are completed.

When the open-cut method is used, traffic will be diverted around the crossing via detours or temporary roads. To minimize the duration of traffic disruption, the pipe will be prepared prior to commencement of roadway excavation. Once the pipeline has been installed, the trench will be backfilled and compacted in lifts in accordance with relevant agency specifications. The roadway will then be resurfaced over the compacted trench. Final selection of crossing methods will be coordinated with state and county engineers and EFSEC. When crossing private roads or driveways, OPL will coordinate crossing activities with private owners.

Railroad Crossings: Railroad crossings will be installed by the jack and bore method only (see Figure 2.3-3) since open-cut construction is not feasible with railroads. The pipe will be installed in accordance with the latest requirements of the American Railroad Engineering Association. Since the minimum depth requirements for uncased crossings are a minimum of 6' of cover in the ditches and a minimum 10' of cover below the rails, additional working space will generally be required to (1) allow the pipeline to reach the greater depth, and (2) provide an area to deposit the materials removed from the larger boring pit. The jack and bore method used will be identical to that described above for roadways. Upon completion of boring, the pits will be backfilled, with the exception of the exposed ends of the pipe. These ends will be left exposed until the mainline spread reaches the railroad crossing and connects to the rest of the pipeline.

FIGURE 2.3-3 - TYPICAL RAILROAD CROSSING

Bridge Crossings: In some cases, bridge crossings will be accomplished by drilling a hole through the bridge abutment to pass the pipe through. The pipe will be secured to the bottom of the bridge on existing beams or trusses. In other cases, the pipe will be installed on the outside of bridges using existing supports and/or pipeline supports installed by OPL as part of construction. Pipe used for bridge crossings will be thicker and will be encased in concrete where necessary to provide additional protection (see Figure 2.3-4).

FIGURE 2.3-4 - WOODEN BRIDGE CROSSING DETAIL

Tunnel Construction: The proposed pipeline will cross through the old Chicago, Milwaukee-St. Paul Railroad tunnel (2.5 miles) at Snoqualmie pass which is now part of the John Wayne Trail System operated by Washington State Parks and Recreation. The pipeline will be buried as it approaches and enters the tunnel. The tunnel floor is rock covered with a ballast material. Along the sides of the floor of the tunnel there are drainage ditches that carry excess water out of the tunnel. The pipeline through the Snoqualmie Tunnel will be buried on the opposite side of the centerline than the side which AT&T and WorldCom have buried facilities. Except for the upper 6 inches which is ballast material the pipe will be buried in rock. The ditch will be 24 inches wide by 36 inches deep. The pipe will have a one inch rock jacket and the backfill will include a covering with two inches of lean concrete poured flush with the rock floor of the tunnel. (See Figure 2.3-5).

FIGURE 2.3-5 - SNOQUALMIE TUNNEL PIPELINE END VIEW

River, Stream and Canal Crossings

See Section 2.14 Construction Methodology for a description of water crossing methodologies.

Pipe Cleaning and Hydrostatic Testing

Before hydrostatic testing, brush pigs will be blown through the pipe in approximately five mile segments to remove any debris that may have accumulated during construction. Manifolds with adapters for compressor fittings will be attached to one end of the segment after the pig has been inserted, and once the compressor is installed the pig will be pushed through the pipe to the other end of the segment where a debris and pig catcher has been installed. As many pigs as is required to clean the pipe, until deemed clean by the inspector, will be blown through the pipe.

Several of these "dry-pigged" clean sections will be tied together to become a hydrostatic test section.

The entire pipeline will be hydrostatically tested in accordance with DOT regulations (see Section 2.5 Water Supply System, for a discussion on sources for hydrostatic test water). If leaks are detected, they will be repaired or the pipeline section replaced and the section retested.

Water for testing will be obtained from local municipal or other public water supplies and transported to the test sections.

Cleanup, Restoration and Revegetation

After backfill is complete and all sections within a given length of pipeline have been tied together, the restoration operation will begin. Material which was pushed aside to make the temporary level working area will be placed back on the right-of-way. The original contours of the land will be restored as closely as possible. As part of the restoration process, all equipment access crossings will be removed. The banks of water courses will be stabilized where appropriate, and restored. Restoration will include revegetation with native riparian species where appropriate.

After the contours have been re-established, the topsoil that had been previously segregated will be redistributed across the surface of the right-of-way, and water bars will be graded across the slopes. This will prevent the formation of large rivulets of water during heavy rains by periodically diverting runoff to the sides of the right-of-way and away from the ditchline. This will protect the slopes during the first few years until the soil stabilizes and vegetation regenerates.

The right-of-way will be chiseled and disc-plowed to loosen soil compacted by the heavy construction equipment. Native grasses and other native vegetation will be planted and fertilized in non-cultivated areas in accordance with landowners' and agency requirements. Hydromulching will be used in areas of steep slopes and areas otherwise not accessible to agricultural cultivating equipment.

The final step will be the establishment of access barriers to prevent trespass on the right-of-way at appropriate points. Much of the brush and stumps generated during the clearing portion of the project will be spread across the right-of-way to establish a natural barrier to travel down the pipeline corridor. Temporary fencing which was installed at the beginning of construction will be removed and original fencelines re-established where appropriate.

As-Built Surveying

The actual pipeline centerline is surveyed during or after right-of-way restoration and revegetation. Pipeline markers will be installed along the route to show the location of the pipeline, identify the owner of the pipeline, and provide toll-free telephone number to contact the owner regarding activities that may affect the pipeline.

Construction Inspection

Each construction spread will be monitored and controlled by ten or more construction inspectors. These inspectors will report to the Chief Inspector who in turn reports to the OPL Project Engineer. The inspectors will be responsible for monitoring the various construction activities, including:

- Surveying
- Right-of-way clearing
- Erosion and sedimentation control
- Trenching
- Stringing
- Bending
- Alignment and root pass welds
- Fill and cap welds
- Weld repairs
- X-raying welds
- Coating inspection
- Lowering in
- Tie-ins
- Corrosion protection
- Backfilling
- Hydrostatic testing
- Clean-up and restoration
- As-built survey

The inspectors will oversee the construction operations and have the authority and the responsibility to shut the construction down if they see anything but full compliance with construction specifications, industry codes and standards or federal, state and local permit requirements.

2.3.4 VALVES

Remotely-controlled block valves will be installed along the pipeline route. These valves will enable rapid response to breaches of the pipeline's integrity and will serve to limit the magnitude of any product release. For location of block valves, see Table 2.9-2 in Section 2.9 Spill Prevention and Control. Each block valve site will be a fenced area approximately 30' x 40'. Facilities at the site will consist of an 8' x 8' valve vault or an above ground valve, a 8' x 8' control building, and a power service pole. Figure 2.3-6 shows a typical block valve layout for an above-ground valve.

FIGURE 2.3-6 TYPICAL BLOCK VALVE LAYOUT

All of the remote valves between the pump stations and delivery facilities will be weld end valves, and located above ground. Weld end valves are less susceptible to leaks than flanged valves. The above ground location will allow more frequent visual inspection of the valves to ensure that leaking does not occur.

If a remote valve requires a below ground installation, the valve will be located within a concrete vault, the pipeline will enter and exit through the walls of the valve vault. The entry and exit points will be sealed to prevent groundwater from accumulating in the valve vault. The valve vault will contain the remotely-controlled block valve, and two pressure transmitters. The pressure transmitters will be used to remotely monitor pipeline pressure upstream and downstream of the block valve, and will also be located on above-ground valves.

The control building will house electronic equipment used to remotely monitor the various instruments at the site and control the position in the block valve. It will also house an uninterruptible power supply which will energize the electronics in the event of a commercial power outage and a telecommunications interface to the pipeline system's Supervisory Control and Data Acquisition (SCADA) network.

Power will be brought to the site from adjacent electric utility service distribution lines. In the event that commercial power is not readily available, a stored-energy actuator will be used on the block valve in lieu of a motor-operator and power for the electronics will be developed on site using a suitable alternative energy source such as solar panels. The stored-energy actuators will be designed to use nitrogen pressure to close the valve and a spring to open the valve. Sufficient nitrogen will be provided to support multiple operations of the valve and to be replenished before the pressure drops below the minimum operating point. The nitrogen pressure will be remotely monitored to support this maintenance function.

As with all other facilities on the pipeline, the combination of equipment, instruments, and SCADA network will allow the OPL dispatcher in the Renton control center to monitor and control the valve site. New data will be transmitted to the control center several times each minute and any commands sent from the control center to control the valve position will be executed immediately. The SCADA system will be preconfigured to automatically detect and alert the pipeline dispatcher about any abnormal occurrences at the valve site.

2.3.5 PUMP STATIONS

Pump stations will be constructed near Thrasher (MP 0) (Figure 2.3-7) in south central Snohomish County and at North Bend (MP 36) in King County (Figure 2.3-8). Construction of two pump stations is proposed in Kittitas County: one east of Lake Easton (Stampede Station, Figure 2.3-9), and a second at Kittitas (Figure 2.3-10). East of the Columbia River, pump stations will be constructed 4 miles east of the Columbia River at Beverly-Burke (Figure 2.3-11) in Grant County, and the last pump station would be constructed approximately 6 miles southwest of Othello (Figure 2.3-12) in Adams County. Initially, only pump stations at Thrasher, North Bend, and Kittitas will be constructed. At a later date, when the volumes on the pipeline increase, the other pump stations would be constructed.

FIGURE 2.3-7 - THRASHER STATION

FIGURE 2.3-8 - NORTH BEND STATION

FIGURE 2.3-9 - STAMPEDE STATION

FIGURE 2.3-10 - KITTITAS TERMINAL

FIGURE 2.3-11 - BEVERLY-BURKE STATION

FIGURE 2.3-12 - OTHELLO STATION

The Thrasher Station will be located on approximately 3.7 acres of land, the other four pump stations will be located on approximately 1.0 to 2.0 acres of land. Construction of the pump stations includes the clearing and grading of each site for the pumps, and connecting piping. The pump site is excavated for foundation construction and laying of pipe. Concrete foundations are poured in place to accommodate the pumps and metering equipment.

The Thrasher, North Bend, and Stampede Stations will have 2 mainline pump units, each capable of 3,000 horsepower (hp). Stations in Kittitas, Beverly-Burke, and Othello will consist of 2 mainline pumps with a maximum rating of 2,500 hp. The pumps are constructed off site and delivered to the site by truck. Each mainline pump will consist of a motor controller, an electric motor driven centrifugal pump, motor-operated suction and discharge valves, and a bypass check valve. The pumps will be sized to jointly provide maximum operating pressure at the ultimate flowrate. Motors will be matched to the initial pump hp requirements and replaced when additional stages are added to the pumps. The foundations will be designed to allow motor replacement to be accomplished without any additional construction activity.

A station check valve will be located downstream of the second pump unit. This valve will prevent backflow through the main pump units.

A pressure control valve may be installed between the discharge of the second pump unit and the station check valve. If present, this valve will regulate flow through the station to ensure that station suction and discharge pressure are maintained within acceptable operating limits. This valve will be installed for fixed-speed drive configuration, but would be omitted for variable-speed drive configurations. The specific configuration has not been determined.

Once the pump units are installed, the pipe connections, valves, and metering equipment are installed. The pump units will be enclosed in a building when necessary to protect the facility and provide noise abatement from the electrical equipment. The pump station facility will be fenced and gated to limit access.

The construction of each pump station will be monitored and controlled by one or more construction inspectors. These inspectors will report to the Chief Inspector who in turn reports to the OPL Project Engineer. The inspectors will be responsible for monitoring the various construction activities, including:

- Surveying
- Right-of-way clearing
- Erosion and sedimentation control
- Foundations
- Piping fabrication
- X-raying welds (radiography)
- Structural

- Electrical
- Instrumentation
- Clean-up and restoration
- As-built survey

2.3.6 TERMINAL FACILITY

The Kittitas Terminal will occupy approximately 27 acres in S12, T17N, R19E in Kittitas County near the community of Kittitas. The site lies north of I-90 and east of Badger Pocket Road, which leads from the Kittitas exit from I-90 to the town of Kittitas. The terminal will support both pipeline operations and truck loading/unloading operations. See Figure 2.3-10, Kittitas Terminal Site Plan.

Major equipment to be installed on site includes:

- Mainline scraper traps and metering
- Manifold and station booster
- Mainline pump units
- Storage tanks
- Truck loading/unloading rack

The entire site will be cleared and graded. The entire site is currently used for agriculture and there will be no impacts to trees, shrubs, or wetlands. Construction on site will include excavation and the pouring of foundations for supporting the equipment. Most of the equipment such as the scraper traps, station booster, and mainline pumps are manufactured off site and trucked to the terminal for installation. Onsite construction includes the erection of the storage tanks, the construction of an office/warehouse building with restroom facilities, and connections to public water supplies and the municipal sewage system.

The construction of the terminal will be monitored and controlled by a construction inspector. These inspectors will report to the Chief Inspector who in turn reports to the OPL Project Engineer. The inspector will be responsible for monitoring the various construction activities, including:

- Surveying
- Right-of-way clearing
- Erosion and sedimentation control
- Foundations
- Piping fabrication
- X-raying welds (radiography)
- Structural
- Electrical
- Instrumentation

- Tank fabrication
- Clean-up and restoration
- As-built survey

2.3.6.1 Pipeline Operating Modes

There are six major operating modes associated with the pipeline portion of the Kittitas Terminal. One of the operating modes has two sub-modes. The modes are identified as follows:

Closed: When both the upstream (14") and downstream (12") line segments are prevented from operating and station inlet, outlet, and bypass valves are concurrently in the closed position, the pipeline operating mode at Kittitas is "closed." This is the idle line operating mode and no product is moving in the pipeline.

Bypass: If the station bypass valve is in the open position and the station inlet and outlet valves are in the closed position, the upstream and downstream pipeline segments are directly connected to each other. In this situation, the pipeline operating mode is "bypassing" the Kittitas Terminal. This mode of operation is used to move products for which there is no assigned tankage at the Kittitas Terminal from Thrasher Station to Pasco in cases where the volume in the pipeline does not require the use of Kittitas's mainline pumping units.

Relaying: The upstream and downstream pipeline segments can be directly connected to each other if the station valves are in the closed position while the station inlet/outlet manifold bypass valves are in the open position. In this operating mode, the terminal is "relaying." This mode of operation is used to move products for which there is no assigned tankage at Kittitas from the Thrasher Station to Pasco, in cases where pipeline volumes require the use of Kittitas's mainline pumping units.

Receiving: When the upstream pipeline segment is connected to the storage tanks, the station inlet valve, manifold inlet valve and a manifold/tank valve are in the open position, but the station bypass valve and manifold bypass valve are in the closed position. In this situation, the pipeline operating mode is "receiving." This mode of operation is used to move products from the Thrasher Station into tanks at the Kittitas Terminal.

Originating: When the downstream pipeline segment is connected to the storage tanks; the outlet valve, manifold outlet valve, and a manifold tank/valve are in the open position; and the station bypass valve and manifold bypass valve are in the closed position, the pipeline operating mode is called "originating". This mode of operation utilizes the station booster pump and mainline pumping units to move products from tanks at Kittitas to Pasco.

Kittitas may also be "receiving" and "originating" concurrently. In this situation, there are two operating submodes. If Kittitas is receiving into one tank while originating out of a second tank, the operating mode is "split stream." If Kittitas is receiving and originating out of the same tank, the operating mode is termed "floating."

The maximum achievable flowrates are shown in Table 2.3-3. The operating capacity is anticipated to be 80% of mean achievable flowrate for the Thrasher to Kittitas segment and 91% of the mean achievable flowrate for the Kittitas to Pasco segment under ultimate buildout conditions.

TABLE 2.3-3
ACHIEVABLE FLOWRATES (BPH)

Segment	Diesel	Gasoline	Mean
Thrasher to Kittitas	5,227	6,785	6,064
Kittitas to Pasco	4,635	6,100	5,417

The physical properties of the products being handled are shown in Table 2.3-4. Batch sizes will vary depending on the amount of each product nominated for shipment.

TABLE 2.3-4
PHYSICAL PROPERTIES OF PRODUCTS TRANSPORTED

Product	Specific Gravity (SGU)	Viscosity (cP)	Vapor Pressure (PSIA)
Gasoline	0.73	0.60	15
Turbine	0.81	2.00	2
Diesel	0.84	4.60	2

2.3.6.2 Storage Facility

The terminal will provide in-transit storage for pipeline movements from the Thrasher Station to Pasco and inventory storage to support loading tanker trucks for local deliveries. At full buildout, the facility will include the following major components.

- Nine main storage tanks
- Transmix/relief tank
- Tank lines
- Fire protection system

All equipment in this area will be rated for ANSI 150 Class service. All portions of the main line process piping which can be isolated during normal operations or maintenance will be equipped with a pressure valve whose outlet will be routed to the station sump via service piping.

Nine main storage tanks, with total storage capacity of approximately 36,120,000 gallons, will ultimately be constructed at the terminal. Six of these tanks will be built as part of the initial construction. The remaining three will be built on an as-needed basis in response to pipeline throughput increases. All tanks will have internal floating roofs under fixed cone roofs. They will be approximately 48' high and vary in diameter from approximately 100 to 150'. A 420,000-gallon transmix/relief tank will also be constructed as part of the initial construction. The transmix tank is used for storage of fuels which are in the intermix zone between different types of fuel being shipped on the pipeline. The transmix tank will be approximately 30' high and 50' in diameter.

Two tank lines will extend from each tank to the manifold area. Each line will be terminated at the tank with a motor operated valve to allow remote/automated control. One line will connect the tank to the manifold to support mainline operations. The second line will connect the tank to the truck rack to support tanker trunk loading/unloading operations. A line from the mainline will extend to the transmix tank, connected via a manually-operated valve which will be locked in the open position under normal circumstances, and a check valve to prevent backflow from the tank into the diked area described below.

The storage tanks will be enclosed by a dike which will provide secondary containment for the storage of tank contents. An impervious barrier will be embedded into the floor and sides of the dike. The dike will be designed to retain at least 110 percent of the largest tank's volume plus a volume equal to the average annual precipitation. A manually-operated drain valve and service piping will connect the diked area with the oil/water separator installed in the truck rack area. The drain valve will normally be closed. It will be opened on an as-needed basis to drain collected precipitation after a visual inspection for sheens. The diked area will be continually monitored during the period of time that the drain valve is open. The discharge rate will be controlled to match the capacity of the oil/water separator.

Fire suppression will include an engine-driven foam generator connected to piping to each tank. Each tank will be equipped with foam chambers. Foam and water monitors will be strategically positioned throughout the tank farm and fed from a dual loop system. Water will be supplied through a connection to the City of Kittitas public water system.

2.3.6.3 Truck Loading/Unloading

The Kittitas Terminal will provide the means for distributing refined petroleum products via tanker truck. The facility will include a truck loading/unloading rack area with the following major components.

1. Two major product loading bays
2. One utility loading/unloading bay

3. Loading/unloading pumps
4. Oil/water separator
5. Vapor recovery unit
6. Ready room and bill-of-lading buildings

A containment barrier will extend around the perimeter of the three bays and define the limits of the contact area. The loading bays will be covered to minimize precipitation in the loading area. The containment area will be equipped with floor drains and service piping routed to the oil/water separator. Fire detection and automatic suppressant dispensing equipment will be installed under the canopy.

Each of the two major product loading bays will be capable of loading all of the available gasoline and diesel products. Each bay will have front- and rear-loading arm sets consisting of approximately five arms. The arms will be designed to support bottom-loading of tanker trucks and will be equipped with dry-break couplings. Each bay will also have front and rear connections to the vapor recovery system. Each bay will be equipped with overfill and grounding sensors which will be used during the loading process. Measurements will be accomplished through off-bay turbine meters and ancillary instrumentation connected to electronic presets and a terminal automation computer system.

The utility loading/unloading bay will be equipped in a similar manner to the major product loading bays, and will have a smaller number of loading arms. This bay will be used in the following situations:

1. When transmix is loaded into tanker trucks for recycling at a refinery;

2. For turbine fuel to be loaded in small quantities for local distribution;

3. For unloading of ethanol, which will not be transported through the pipeline;

4. For product to be unloaded into the transmix tank. (Occasionally a driver error or an equipment malfunction results in off-specification product being generated during the normal loading process.)

Loading/unloading pumps will be installed between the loading bays and the tank lines.

2.3.7 PASCO DELIVERY FACILITY

The Pasco Delivery Facility is proposed to occupy approximately 0.87 acres in S35, T9N, R30E in Pasco, Franklin County near the intersection of U.S. 12 on Sacajawea Park Road. This site is at the terminus of the 231-mile pipeline project. See Figure 2.3-13 Pasco Delivery Facility.

Figure 2.3-13 Pasco Delivery Facility

The Pasco Delivery Facilities will be composed of, but not limited to, the following:

- Scraper receiving trap
- Meter skid consisting of two 6" meters
- Meter prover rated at 4,000 BPH
- Sample building of approximately 8' by 40'
- Control building of approximately 12' by 35'
- Sump tank
- Meter manifolds at custody transfer location
- Re-injection pump for transmix and surge relief

In addition, a surge relief and transmix tank supplied by others on a site immediately adjacent to the delivery facilities will be utilized as an integral part of the facilities.

The proposed site is level, clear of trees, and has minimal vegetation (small shrubs). Very little site work will be required before actual construction can begin. The site is not utilized and is vacant of buildings. Construction will include excavation for the installation of concrete foundations for the delivery equipment, construction of a control building, and connections to public water supplies and the municipal sewer system. The control building will include a restroom.

The scraper trap, the meter skid, the sump tank and the reinjection pump will be manufactured off site and delivered to the site by truck for installation.

The construction of the delivery facilities will be monitored for quality by construction inspectors who will report to the Site Construction Engineer. This engineer will in turn report to the OPL Project Engineer. The inspectors will be responsible for the quality control of the various construction activities, including:

- Surveying
- Site preparation
- Erosion and sedimentation control
- Excavation
- Forming and concrete installation
- Piping fabrication
- Radiography
- Equipment installation
- Electrical and instrumentation
- Building construction
- Hydrostatic testing
- Painting
- Fencing
- Cleanup

2.3.8 COMMUNICATION SYSTEM

Construction of the Cross Cascade Pipeline will include installation of equipment and cabling to provide voice and/or data communications to the various facilities along the pipeline. Equipment and cabling will be installed to provide real-time operational data communications between the Renton Control Center and the various pump stations, Kittitas storage/distribution terminal, Pasco delivery facility, and mainline block valve sites. Additional equipment and cabling will be installed to provide normal business voice and data communications to the various pump stations, Kittitas storage/distribution terminal, and Pasco delivery facility. A variety of approaches to providing the required functionality were considered and the following options were identified as being potentially practicable. A final determination about the approach to be implemented for each site will be made at the time of construction.

Real-time operational data communications can be supported through a combination of the following four approaches:

- Telephone company circuits
- Satellite terminals
- Point-to-point radio pairs
- Fiber optic cable

Normal business voice and data communications can be supported by using a combination of the following three approaches:

- Telephone company circuits
- Satellite terminals
- Fiber optic cable

The impacts associated with implementing each of these approaches is described below.

2.3.8.1 Telephone Company Circuits

Telephone company circuits are available near the major facilities associated with the pipeline and in many of the areas traversed by the pipeline alignment. The following table summarizes the distance from each pipeline facility to the nearest telephone company pedestal. There was one block valve site which was not surveyed due to landowner access denial.

Construction would be done by the provider and involve using a small trencher to open a slit trench, placement of direct burial cable or conduit in the trench, back-filling the trench, and restoration of the disturbed area. The disturbed area would be less than ten feet wide and the actual excavation should be no more than 18 inches wide. The temporary impacts associated with this construction are anticipated to be minimal.

No permanent impacts are expected to result from this construction.

Depending on the route of the telephone company's main cable, it may be possible to reduce the amount of trenching required by installing another pedestal. OPL will consult with the provider about this issue during final design and implement this approach where it is practical to do so.

TABLE 2.3-5
DISTANCE TO NEAREST PEDESTAL FROM PUMP STATIONS AND BLOCK VALVES

Site	Distance (mile)	Site	Distance (mile)	Site	Distance (mile)
Thrasher (BV #1)	<.10 mile	BV #11	<.10 mile	Kittitas (BV #20 and #21)	<.10 mile
BV #2	<.10 mile	BV #12	<.40 mile	BV #22	<.10 mile
BV #3	<.10 mile	BV #13	<.20 mile	BV #23	<.10 mile
BV #4	<.10 mile	Stampede Pass (BV #14)	<.10 mile	BV #24	<.40 mile
BV #5	<.40 mile	BV #15	<.10 mile	Beverly Burke (BV # 25)	<.10 mile
BV #6	<.40 mile	BV #16	<.10 mile	BV #26	<.10 mile
BV #7	<.10 mile	BV #17	<.10 mile	BV #27	<.10 mile
BV #8	<.10 mile	BV #18	<.60 mile	Othello (BV #28)	<.30 mile
North Bend (BV #9 and #10)	<.10 mile	BV #19	<.10 mile	Pasco (BV #29)	<.10 mile

2.3.8.2 Satellite Terminals

Satellite terminals could be installed at all of the major facilities associated with the pipeline and in many of the areas traversed by the pipeline alignment. The following table summarizes the availability of a view angle from each pipeline facility to an appropriate satellite. There was one block valve site which was not surveyed due to landowner access denial.

Construction would involve installation of the satellite dish and an interconnecting cable to the control building located at the facility. The 1.8 meter satellite dish would be mounted on a 3’ to 6’ tall support mast made of 4” outside diameter Schedule 40 steel pipe. A small foundation would be installed to provide a stable mounting surface for the base of the mast. Depending on the proximity of the mast to the control building, the interconnecting cabling may be supported on an aerial messenger or installed in an underground conduit. Installation of the conduit would involve using a small trencher to open a slit trench, placement of the conduit in the trench, back-filling the trench, and restoration of the disturbed area. The disturbed area would be less than ten feet wide and the actual excavation should be no more than 18 inches wide. The disturbed area would be entirely within the areas that will be disturbed by other pipeline or pipeline facility construction activities. Therefore no incremental impacts to the physical environment are expected to occur from the installation of this equipment.

At the pump stations, Kittitas storage/distribution terminal, and Pasco delivery facility, the incremental visual impact is expected to be insignificant since the view will be predominated by the other equipment and structures associated with the facility. At block valve sites, the incremental visual impact will be somewhat greater since there will be less in the way of other equipment and structures to blend into and overall judged to be minimal.

TABLE 2.3-6
AVAILABILITY OF VIEW ANGLE

Site	Yes/No	Site	Yes/No	Site	Yes/No
Thrasher	Y	BV #11	N	Kittitas (BV #20 and #21)	Y
BV #2	Y	BV #12	N	BV #22	Y
BV #3	Y	BV #13	N	BV #23	Y
BV #4	Y	Stampede Pass (BV #14)	Y	BV #24	Y
BV #5	N	BV #15	Y	Beverly Burke (BV # 25)	Y
BV #6	Y	BV #16	Y	BV #26	Y
BV #7	Y	BV #17	Y	BV #27	Y
BV #8	Y	BV #18	Y	Othello (BV #28)	Y
North Bend (BV #9 and #10)	Y	BV #19	Y	Pasco (BV #29	Y

2.3.8.3 Point-to-Point Radio Pairs

The use of radio was not evaluated as a general means of providing communications to all facilities. This decision was based on several factors:

- Multiple tall towers would be required through the Cascades
- Leased telephone circuits would be required from each master radio location
- The locations are linear rather than clustered, only a few remotes could be polled from each tower site thereby reducing the economies associated with a company-owned radio system.

In a few cases, such as where there may be block valves fairly closely spaced on either side of a river, point-to-point radio pairs may be a practical option. No specific sites have been identified as candidates for this approach at the present time, but OPL desires to retain the flexibility to use this approach if it is found to be a preferred option during final design.

Construction would involve installation of the radio antenna and interconnecting cabling to the control building located at the facility. The antenna would be mounted on a 10’-20’ tall self-supporting steel tower. The tower would be triangular in shape and measure approximately 24” across each face. The antenna would measure approximately 18” high by 36” long and would be mounted near the top of the tower. A small foundation would be installed to provide a stable mounting surface for the base of the tower. Coaxial cable would be attached to the antenna and routed downward along one face of the tower. Depending on the proximity of the tower to the control building, the coaxial cable may be supported on an aerial messenger or installed in an underground conduit between the tower and the control building. If the distance between the tower and the control building would result in unacceptable signal strength losses in the coaxial cable, the radio may alternatively be located in a weatherproof box mounted at the base of the tower. In this case power and serial communications cables would be run in a conduit between the box and the control building.

Installation of conduit would involve using a small trencher to open a slit trench, placement of the conduit in the trench, back-filling the trench, and restoration of the disturbed area. The disturbed area would be less than ten feet wide and the actual excavation should be no more than 18 inches wide. The disturbed area would be entirely within the areas that will be disturbed by other pipeline or pipeline facility construction activities. Therefore no incremental impacts to the physical environment are expected to occur from the installation of this equipment.

A permanent visual impact will result from this construction. At the pump stations, Kittitas storage/distribution terminal, and Pasco delivery facility, the incremental visual impact is expected to be insignificant since the view will be predominated by the other equipment and structures associated with the facility. At block valve sites, the incremental visual impact will be somewhat greater since there will be less in the way of other equipment and structures to blend into, but the overall impact is judged to be moderate.

2.3.8.4 Fiber Optic Cable

Fiber optic cable could be installed to connect all of the facilities associated with the pipeline with each other and the public communications network. Such an undertaking is not economically feasible for OPL to pursue solely for its own purposes. Therefore OPL will only utilize this approach if it can secure a commercial partner to assist with the cost of materials and installation without impacting the underlying schedule for permitting and construction of the pipeline.

Any such arrangement will include terms requiring the commercial partner to separately secure any licenses or other regulatory approvals that are needed to engage in their segment of the communications business and to cure any defects with respect to the right-of-way that OPL has secured. Curative work on the right-of-way will include securing right-of-way in areas where OPL has no cable rights whatsoever, securing additional rights in areas where OPL's rights are limited to installation of cable for its sole use, and resolution of any issues related to the application of the equal access provisions of the Communications Act of 1996 on lands owned by the State of Washington or its agencies. The terms of any such arrangement will also provide that installation of the fiber optic cable must be coincident with the construction of the pipeline.

The construction would consist of approximately 230 miles of fiber optic cable installed within the Cross Cascade Pipeline Project footprint. Ancillary facilities would consist of regeneration stations which would be collocated with the pipeline pump stations, splice boxes and manhole access at an average spacing of every 10,000 feet, and location marker signs collocated with the pipeline location markers.

The construction would involve installation of a conduit in the trench along with the pipeline and subsequent pulling of the fiber optic cable into the conduit.

The conduit would be either 4-inch diameter multi-chamber HDPE conduit or 4-inch diameter steel pipe. If steel pipe is used, three 1 1/4-inch or four 1-inch polyethylene innerducts would be placed in the conduit. One of the cambers/innerducts would be used for the initial installation of the fiber optic cable. The remaining chamber/innerducts would be used for restoration and future use. The presence of the additional chamber/innerducts would prevent or reduce potential disturbance resulting from additional cable being placed along the route or replacement work.

Flatbed trucks would transport joints of conduit/pipe, lengths of innerduct, and reels of fiber optic cable to the site.

The same trench that is being opened to allow installation of the pipeline would be used for the fiber optic cable conduit. The conduit would be placed in the trench by hand and positioned in the trench below and/or to the side of the pipeline. This will ensure adequate burial depth in all locations. Adequate clearance would be maintained to allow working room around the pipe to facilitate any future maintenance activities. The minimum clearance between the conduit system and facilities owned by others such as any gas, water, or oil mains, electric power, or other conduits would be no less than 12 inches when crossing and 18 inches when paralleling the conduits. Generally, the conduit system would cross under foreign structures in order to provide for maintenance of those structures. A small amount of incremental excavation may result from providing for these clearances, but all work will remain within the footprint of the area that would be disturbed by pipeline construction activities alone so that no incremental environmental impacts occur as a result of the fiber optic cable installation.

A metal or fiberglass splice vault will be installed at each splice point along the cable running line and at such other points as may be needed to facilitate pulling of the fiber optic cable. The splice vault will generally consist of a permanent vault section, approximately three-to four-feet in diameter and with its top positioned one to two-feet below the existing grade. After the splicing operation is completed the vault section will permanently house the splice. A locating device will be placed above the lid before backfilling to facilitate relocating the vault.

Workholes will also be located along the route for cable splicing, pulling, and maintenance. The workholes will be flush with the ground and consist of either cast-in-place or precast concrete. Dimensions and configurations of the workholes may vary as required.

Workholes will be designed to resist all live, impact, and dead loads. Live and impact loads are equivalent to H-20 and HS-20 loads as stated in the latest revision of the American Association of State Highway Officials (AASHO) Standard Specification for Highway Bridges. The dead load consists of soil surcharge and structure weight. Workholes will be designed to resist lateral forces as well as vertical forces resulting from live, impact and dead loads. The combination of loads that produce the maximum shear and moment will be used to design the workholes.

Workholes will be adequately reinforced to resist stresses resulting from the above loading conditions. Special reinforcing will be provided at openings in the workholes. The concrete used for the workholes will have a 28 day compression strength not less than 3,000 psi. The reinforcing steel will have a yield strength of 60,000 psi (Grade 60).

Once the pipeline and conduit are in place, the trench would be backfilled, except at the workholes or splice vault locations. When a major section has been completed , the fiber optic cable would be pulled through using a nylon cord. The nylon cord would be blown through the conduit by using compressed air and an appropriately sized plug. The cord would then be used to pull the cable into the conduit.

Stream, river, canal, wetland, road, and railroad crossings will be accomplished using the same construction techniques that are used for the pipeline. Where trenching is used to cross a particular feature, the fiber optic conduit will be installed in the trench along with the pipeline. Where jacking-and-boring is used to cross a particular feature, the same bore and receiver pits will be used to install both the pipeline and the fiber optic conduit. Where directional drilling is used to cross a particular feature, the bore will be enlarged enough to allow the fiber optic conduit to be pulled in along with the pipeline.

An area approximately 35 feet by 50 feet would be needed at each pump station site for installation of regeneration equipment. The regeneration building would be approximately 12 by 30 by 8 feet. The building would contain optical regenerator equipment, 48-volt batteries, and battery chargers. The building would be air-conditioned and heated by electric strip heaters. Construction would involve pouring a foundation for the regeneration building; moving the prefabricated regeneration building to the site and placing it on the foundation; and completing wiring between the regeneration building and the electrical substation. Power for each regeneration station would be tapped from the electrical substation being installed to support operation of the pump station. In the event of a power failure, the batteries at each station would maintain equipment function for 8 hours, by which time power should be restored. If a prolonged commercial power outage were expected, a portable emergency generator would be brought onsite to power the regenerator. Storage batteries with increased capacity would be placed at any station where repairs might take longer in order to ensure continual operation. All structures which are a part of the regeneration station would be built to meet or exceed uniform building code standards.

The construction workforce directly attributable to installation of the fiber optic cable is expected to average 4 to 6 workers per construction spread.

Following construction location marker signs would installed along with the pipeline location markers. Placement of these signs will be dictated by the pipeline maker location requirements. Marker signs would display the local one-call telephone number and an emergency telephone number for the cable company.

If installed, the fiber optic system is anticipated to be kept in operation for the life of the pipeline. Depending on the type of cable installed, the expected lifetime of the cable itself could be up to 75 years. At the end of cable service, the cable could be abandoned in place in favor of a replacement installed in one of the other chambers/innerducts Equipment at the regenerator and terminal stations would have a shorter lifetime, particularly because of rapidly advancing technology, but could be easily replaced.

A permanent visual impact would result from this construction. At the pump stations, Kittitas storage/distribution terminal, and Pasco delivery facility, there would be an incremental visual impact as a result of the regeneration building. However, this impact is expected to be minimal since the view will be predominated by the other equipment and structures associated with the facility.

The cable and associated facilities would be maintained during the project life. Maintenance would include visual inspections of buildings and the right-of-way and periodic repair of any facilities which show unacceptable wear or deterioration. Regenerator stations would be unmanned, but would be visited every 1 to 2 weeks for inspection and maintenance. The level of right-of-way maintenance would be dictated by pipeline requirements. No special vegetation control measures would be implemented as the result of the installation of the fiber optic cable.

A break in the cable or other system failure would temporarily disrupt communications, but would cause no public hazard. If a break in the cable occurred, an alarm would go off immediately and indicate between which regenerator stations the break occurred. The exact location of the break would be determined by use of an optical time domain reflectometer. The broken cable would then be dug up and spliced. A temporary splice would be made immediately and a permanent splice made during a time of low use (e.g., night). Periodic aerial reconnaissance of the cable right-of-way would be a by-product of normal pipeline surveillance activities.

TABLE OF CONTENTS

Page